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A MULTI-ELEMENT ANALYSIS OF THE EFFECT OF TEACHER AIDES IN AN "OPEN"-STYLE CLASSROOM

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Open classrooms with few rules, individualized instruction, and informal class organization present new problems for the application of behavior principles. The effects of three types of teacher aides on student achievement and on-task behavior were studied. Each was compared with a standard no-aide condition. Subjects were 54 third graders in two "open"-style classrooms. The three types of aide, helping adult, disciplinary adult, and helping fifth-grade aide, were compared in a multi-element design with a no-aide control. The helping-adult aide significantly affected the academic output of the class, when compared with the no-aide condition. All aide conditions produced more academic work and on-task behavior than did the standard no-aide condition.

DESCRIPTORS: academic behavior, peer tutoring, aides, open classroom, control, discipline, multi-element design, on-task behavior, self-management, time sample, primary-grade students

In the past decade, the application of behavioral techniques to analyze and solve problems of classroom management in elementary schools has approached the level of a well-understood technology ready for use by those teachers ready to apply the techniques. It is not surprising that this technology has developed almost exclusively in traditional self-contained classrooms. Such classrooms offer the degree of experimental control, due to their physical arrangement (four walls, one teacher, set schedule and curriculum), required for sound research methodology to emerge. In recent years however, a new educational model from Britain (Brickman, 1970; Rathbone, 1971; Spodek, 1971) has resulted in the construction of so-called "open schools" (Nations Schools, 1971; Nyquist, 1971; AASA Report, 1972). Perhaps because of pressure in the United States to measure achievement levels (Fromberg, 1974; Gaudia, 1974; Samph and Campbell, 1974), the usual American open classroom is different from its English counterpart with respect to the entirety of the child's determining role in curriculum selection (Nations Schools, 1971*b*). Both British and American open schools, however, are characterized by a rejection of age-grade norms, a decentralized classroom with various subject learning areas, and a wealth of learning materials other than books and including other students, for concrete experiential learning. In these classrooms, children work independently and at their own rates with a variety of materials reflecting individual achievement levels. In ideal situations, teachers work almost entirely with individuals or small groups of four to six students.

The classroom has in turn been remodelled to fit the demands of a more flexible, individual-centered, as opposed to group-oriented, approach. The removal of walls between classrooms to facilitate the movement of children from one "learning center" to another, and the simultaneous use of several subject matter learning areas by the class while supervised by a team of teachers, has forced a more "open" architectural style (Thomas, 1971).

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Concurrent with the development of the open-classroom system are problems related to classroom management, such as continuous planning of topic-relevant teacher activities, specific student communication skills development, and uninvolved students (Fromberg, 1974; Nations Schools, 1971*a*). In classrooms in which out-of-seat behavior, conversation with other students, free time for individual pursuits, and largely individualized responsibility for learning rate are inherent to the system, the definitional monitoring of off-task behaviors and the degree of experimental control possible becomes more difficult. Yet, precise monitoring is perhaps more crucial for the psychologist interested in studying the system, and for the teacher concerned with involving all students in the learning process.

An additional problem is that the weight of all classroom instruction and materials development falls on the teacher, who is expected to individualize the instructional materials from five or six different learning materials available for each subject area for every child. The teacher is also expected to give individual tutorial help to students from a wide range of competency levels, maintain some degree of classroom control, and monitor the level of academic progress of each student.

In England, aides, employed part-time, are used extensively to help free the teacher to teach (Tag, 1971), yet extensive use of aides in American open-style classrooms is the exception, rather than the rule. In some areas, such as California (Time, 1976), parents are being used as aides on an experimental basis, but this has been introduced for convenience, with little or no experimental evidence to demonstrate the benefits of such an innovation. Research in the open classroom to date has not been concerned with the question of aides. Myers (1971) and Reudi and West (1973) investigated the consequences of the open classroom on students' self-perception and their perception of their teachers. However, the use of behavior-analysis techniques to measure change in open classrooms has been extremely limited. Ascare and Axelrod (1973) attempted to implement a token system in four open classrooms with students who consistently failed to engage in academic activities. The majority of the students, however, remained on the open plan. In addition, no measurement was made of the rate of student academic output as affected by the token system.

The present study assessed the use of teacher aides in an American-style open classroom. Behavior analysis techniques were used to measure changes in elementary classroom productivity, academic output, and on-task behavior, under three different instructional aide conditions. These conditions were compared with the output of a no-aide condition that prevailed previously in the classroom.

METHOD

Subjects and Setting

Fifty-four third-grade students in two classes in a local public elementary school, randomly assigned to their respective classes by the principal, served as subjects. Informal assessment of educational attainment indicated a wide range of abilities represented in the two classes, ranging from students who were 1 yr behind to 1 yr above the third-grade norm in language arts. The subjects' ages ranged from 7 yr, 10 months to 10 yr, five months. Students with special learning disabilities were in the special-education class during the observation period, and did not serve as subjects. Socioeconomic levels ranged from students whose family income was below $2000 a year to more than $20,000 a year.

The research classrooms were two of the four third-grade classes in an "open pod" system classroom. This particular system provided one large room, approximately 19.7 by 31.5 m, for each grade. The four "classrooms" were situated in the four corners of the larger room, each with its own blackboard, sink, utility closet, bulletin boards, and randomly arranged tables at which the students sat. In the center of the room, between the four classrooms was the "center"

area, used for special projects, class meetings, and small group and individual instruction. Each child had a "home seat", but could change his or her seat depending on the different activities in which the class or individuals were involved.

Measures of Behavior

Academic performance. The language arts period lasted from 10:00 a.m. to 10:45 a.m. four mornings each week. The teachers worked intensively with individuals or small groups on special problem areas, while other students worked at their own paces on a variety of materials prescribed for their achievement levels.

Each day at the close of the language arts period, the experimenter went to each child's folder and counted the number of assignment units and group activities completed to an 80% criterion (as designated for a passing score by the classroom teachers). These units were then totalled for the class, and represented the total number of units completed by the class on that day. The count occurred immediately following the end of the language arts period to ensure the accuracy of the measure, as the work completed only in that period. The longer work units were subdivided into exercises necessitating different completion behaviors from the students. As these subdivisions represented different language arts operations, and were scored separately, it was decided to count each subdivision as a completed unit, thus avoiding penalizing children for working on longer units. Unit sizes were then all approximately 10 questions in length. The teachers were not informed ahead of time as to the day's aide condition, to avoid potential confounding of treatment with the difficulty of assigned material.

Reliability was computed once per week in each classroom by having the classroom teacher make an independent count across all students of the number of academic units completed to criterion that day. This number was then compared to the number of the experimenter's count, the larger number divided into the smaller, and multiplied by 100 to get percentage agreement. In eight checks, the reliability across the two classrooms never fell below 92%.

Off-task behavior. Preliminary observations and consultations with the teachers generated the following definitions for off-task behavior: (a) out-of-seat behavior not related to work: wandering around, stopping to talk to another student on the way to or back from prescription materials about matters unrelated to classwork or projects; (b) nonappropriate talking: speaking to a neighbor for other than academic reasons, yelling across the room, loud noise making; (c) nonattention behaviors: looking around the room, sleeping if prescription daily sheet had not been completed, doodling, glancing up from work for nonacademic reasons during an observation interval, hitting, pushing, stealing from or verbally distracting another student.

Observation Procedure and Reliability

Two observers in each class each day sat or stood along the edges of the classroom or in chairs near enough to the observed student to overhear conversational content. They avoided eye contact or verbal interactions with students or the aide. The observation sessions lasted throughout the 45-min language arts period.

Each class was divided by tables into two sections, with equal numbers of students in each section. This was an observer-oriented division, and not one actually physically present in the classroom. Each observer was responsible for observing 13 or 14 students each period.

On one side of the observation sheet were the names of the students in an observer's section of the class. These names were matched to labels taped at each child's seat to help the observers identify each child. Each observer had a stopwatch and observed each child for 30 sec of continuous observation, broken into six 5-sec intervals. Once every 5 sec, the observer recorded whether the subject was entirely on-task during the interval, or whether at least one off-task behavior occurred. No record was made of specific types of off-task behavior. At the conclusion of the 30-sec interval, the observer looked

for, then began the same procedure with the child next on the list, until each child had been observed once. The observer then began the sequence again, and continued this procedure until the end of the language arts period. In this way, the behavior of each child in that observer's half of the class was recorded for 30 sec once every 7 min.

On-task behavior was calculated by counting the number of 5-sec intervals on-task. This was then divided by the total intervals observed, and this figure multiplied by 100, to obtain the percentage of on-task behavior for that half of the class (+ = on-task intervals/total intervals × 100). The two percentages for the two halves of the classes were then summed and divided by two, to generate an estimate of total class on-task behavior for that section.

A reliability check was made on two of the observers each day they observed, and the reliability of the other six observers was checked at least four times each for 7 min of continuous recording by an independent observer. The percentage of agreement was calculated by dividing the number of intervals in which there was agreement as to either on- or off-task occurrence of behavior by the total number of intervals, multiplied by 100, (R = agreement/total number of intervals × 100). Twenty-nine reliability checks were made on the eight observers over the 38 days of the study. Reliability checks were 7 min of continuous recording; observer reliability never fell below 82%, with an average of 94%.

Aide Conditions

Four different aide conditions were randomly instituted using a multi-element design in each classroom during the four language arts periods each week. The three types of aides were chosen to represent the most probable range of characteristics of untrained aides. The four different aide conditions were:

(1) *A helping-adult aide:* this was a female aide who was present to respond to students' academic questions, explain concepts when asked, and discipline when necessary. If the level of noise in the classroom seemed excessive, the aide turned off the lights, a signal to the students to be quiet and pay attention. She then said: "I think we can work more quietly than this", and turned the lights back on. Female aides were drawn from the pool of observers. All female aides served as both helping and disciplinary aides in both classrooms to distribute the effects of individual differences among treatment conditions.

The discriminative stimulus for the children to understand that she was a helping aide was a large yellow "happy face" worn on the front of her blouse, and a short introduction speech given by the teacher at the start of each prescription work period.

> This is Miss ———. She will be in our class today to answer questions on your work. You *must* raise your hand for her to come and help you. Please remember that if she turns off the light, you are to be quiet and listen. You may also ask your neighbor if you need help.

(2) *A disciplinary adult aide:* this aide did not respond to students' academic questions, but walked around the room, and had the power to discipline in the same manner as did the helping aide. The only verbal interaction that this aide employed was in response to a child's academic question. She was permitted to say: "I'm sorry, I cannot answer your questions." This aide's value lay only in the effect of an adult's proximity to a student, and in her class disciplinary power. Although this aide is antithetical to the philosophical tradition of the British open schools, she was included as a probe to detect what the effect might be in the worst case of an untrained aide.

This aide wore a large, foil-covered badge with "Police" written on it, on the front of her blouse, and was introduced by a speech given by the teacher before the start of each session.

> This is Miss ———. She will be in our

class today. If she turns off the lights, remember, you are to be quiet. She cannot answer your questions today, so please do not raise your hand for help. You may ask your neighbor if you need help.

Female aides were chosen for these two conditions to approximate most closely the realistic conditions that might prevail if aides were to be used in elementary school classrooms. In addition, they were chosen to represent the two extreme kinds of help that might be elicited from aides untrained in reinforcement or in curriculum techniques.

(3) *A helping fifth-grade aide:* this aide fulfilled the same requirements as the helping-adult aide. The disciplinary measures and discriminative stimulus were also identical. Each of the 14 aides required by the study were randomly selected from a pool of fifth-graders generated by their teachers. The criteria for selection for the pool were: (1) excellent progress in language arts as judged by their teachers; (2) reliable, as defined by the ability to follow instructions; (3) social maturity, as evidenced by helping or self-help behaviors exhibited in class.

(4) *The no-aide condition:* neither an aide nor the teacher was present in the classroom during the prescriptive work period. The children worked on their own or with neighbors while the teacher concentrated on special instruction or curriculum development in the center of the pod unit between the four classes. Because of the lack of walls between classrooms, the class was visible to her. This was the usual procedure in the classroom, as it enabled the teacher to work uninterrupted with those that needed special attention. Thus, when the classes were not working in groups on projects, the teachers' standard procedure was to assemble students for special instruction for a time, and then return them to the classroom and assemble some other students. The discriminative stimulus for this condition for the children was a speech at the beginning of this period: "Today I will be busy with small groups. If you do need help, please ask your neighbor. Do not interrupt me while I am working outside the class."

Those helping as adult and disciplinary aides were volunteers drawn from students in an undergraduate psychology class.

Experimental Design

A multi-element (Ulmann and Sulzer-Azaroff, 1975) or equivalent time samples (Campbell and Stanley, 1966) design was used in which the three aide conditions and the no-aide condition were randomly sequenced in each class across the four available language arts periods each week. This design was chosen because it provided experimental control over the fluid experimental setting of the open classroom. The design yielded frequent samples of the behavior and allowed for repeated replication of circumscribed treatment effects (Sidman, 1960). Interclass and intersubject variability due to sequence of treatment effects was controlled by the random order of presentation of treatments each week. Interaction effects from ongoing environmental changes, such as different performance levels due to day of the week effects, substitute teachers, maturation of subjects, and length of time in the system are also minimized by exposing all subjects to all treatment conditions over the same time period. Employing a multi-element design does not take advantage of the fact that even a weak treatment, if applied consistently over a long enough time, may produce some change in behavior. However, in not doing so, any consistent differences in results between treatment implies that the changes in behavior are immediately controlled by the treatment itself, rather than by chance or an uncontrolled event in the environment. When these consistent differences are found while using the multi-element design, it presents a strong case for the different treatments' ability to produce immediate and significant effects.

Procedure

The teachers whose classrooms were used, utilized the prescriptive teaching method to teach

mathematics and language arts. Each of the children had a prescription sheet of daily assignments made out according to their level of attainment in the different available language arts materials. These assignments were drawn from a pool of five possible language arts sources: reading books, SRA Reading Lab (1969), New Practice Readers (1960), Barnell-Loft (1970), or phonics materials. The child worked through the units assigned at his or her own speed.

At the beginning of the language arts period, children retrieved their folders containing their prescription sheet. After preliminary instructions, the teacher introduced respective aides, and then took the children she was to work with out of the class.

As each unit was completed, the student went to a selected "student checker of the day", who retained the answer keys to the different materials. This checker scored the students' work with a colored marking pen, after which work was deposited in a folder and the student proceeded to the next unit. This folder was turned in and checked by the teacher and the experimenter at the end of the language arts period.

The sequence of conditions was randomized for each week. The order for each aide condition was the same each week for both teachers, but allowed for the limitation imposed by each teacher's library day. Thus, while each class had the same sequence of aides each week, they did not have the same aide conditions on the same day, allowing one aide to serve in the same role in the two classrooms.

RESULTS

Academic Output Data

In both classes, the three aide conditions, as indicated by a two-factor, repeated measure analysis of variance, resulted in significantly increased academic output ($p < 0.01$, df, 3,27), compared to the no-aide condition. Figures 1 and 2 show the number of completed academic units for each condition when compared to the no-aide condition across the two classrooms. Further analysis of the variance between means of the significant aides variable with the Newman-Keuls test indicates that the largest significant variability occurred between the no-aide condition output (Class I mean = 65 units per day, Class II mean = 56 units per day) and the helping-adult aide output (Class I mean = 82 units per day, Class II mean = 73 units per day). An overall mean gain of 17 units per day (a 28% increase) was thus achieved using a helping-adult aide in the classrooms.

Examination of the data shows fairly stable effects across classes and time during the no-aide condition. In both classrooms, during the helping adult and fifth-grade aide conditions, significantly ($p < 0.01$, df, 6,27) increasing amounts of work were completed as the study progressed.

On-Task Behavior

The two-factor, repeated measures analysis of variance design demonstrated a statistically ($p < 0.05$, df, 3,27), but perhaps not socially significant increase (10%) in on-task behavior in favor of all three aides over the no-aide condition.

As indicated in Figures 3 and 4, and by the Neuman-Keuls test, on-task performance over the weeks of the study did not change significantly. The highest average percentage (80%) of on-task behavior occurred while the disciplinary adult aide was present, and the lowest (72.5%), during the no-aide condition.

Intercorrelations

To determine if higher on-task performance was associated with increased academic output, a Pearson *r* correlational analysis was performed across classes. Academic output was not significantly associated with a high on-task percentage for any of the conditions in either class.

Aide Interactions

The number of aide-to-student or aide-to-class interactions per language arts period by the individual aides was collected on 18 of 38 days

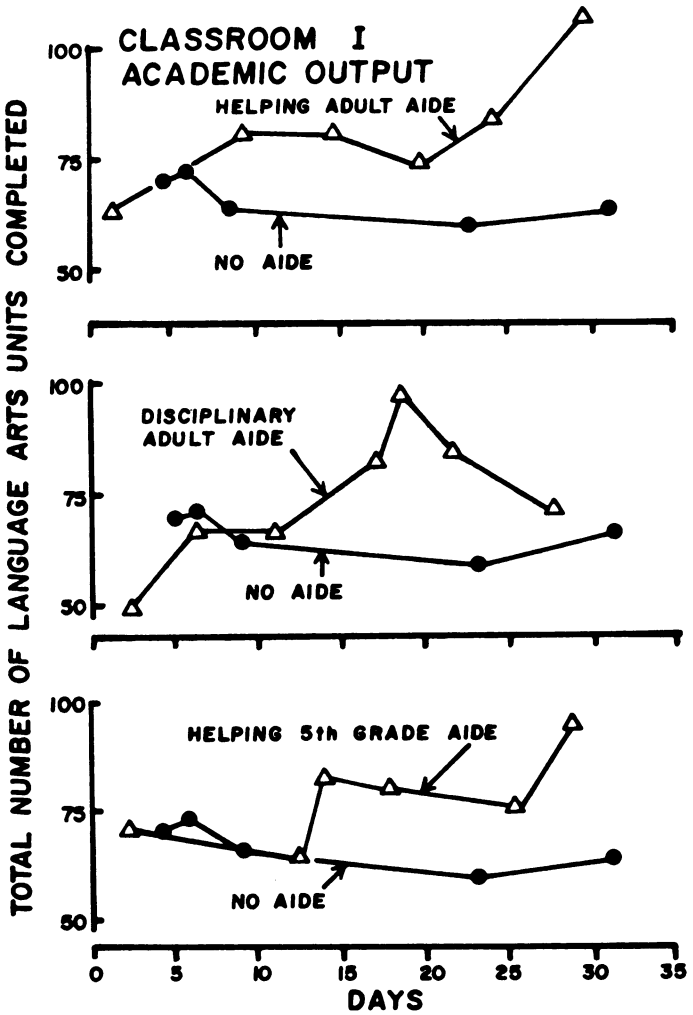

Fig. 1. Number of academic units completed under each aide condition in Classroom I.

of the study to determine if this was a significant aide characteristic. Using a single-variable analysis of variance, significant ($p < 0.01$, df, 2,16) differences were indicated between the aide conditions on the number of interactions per observation period. Examination of Table I reveals that the helping-adult and fifth-grade aides, who were instructed to help with academic material as well as discipline, interacted most frequently with students in the class.

DISCUSSION

Compared to the no-aide system in effect before the study, when differing types of aides were introduced into the open classroom (regardless of instructions to the aides), class output increased. Additionally, the high rate of unit com-

Table I

Number of Aide Interactions

Condition	*Number of Observations*	*Mean Number of Interactions per Class Period*	*Range*
Helping adult	5	26.4	22-35
Helping fifth-grade aide	6	20.8	3-32
Disciplinary adult aide	7	12.4	4-20

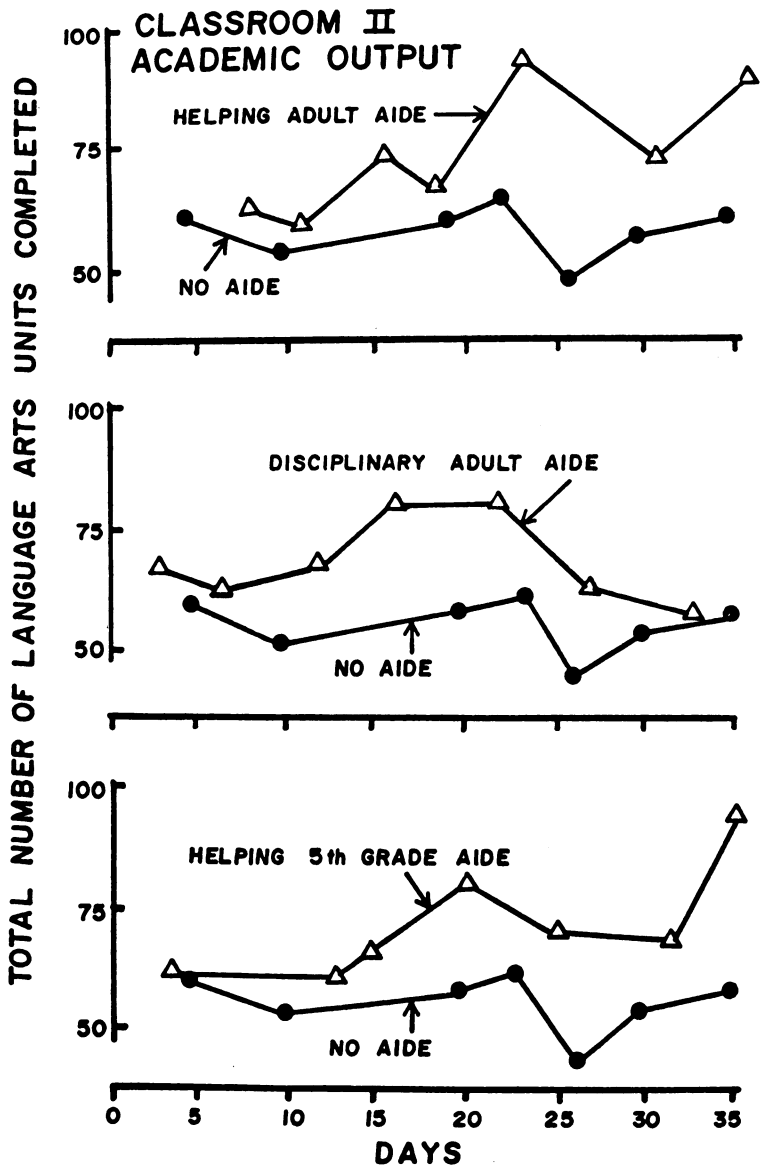

Fig. 2. Number of academic units completed under each aide condition in Classroom II.

pletion when a fifth-grade aide was present argues well for the practical and economic feasibility of an aide-teacher system in the open classroom.

The type of aide also affected the percentage of on-task behavior present in the classroom, although the higher on-task percentages of the disciplinary and fifth-grade aide conditions in the classrooms were not correlated with the highest academic output condition. This may demonstrate that although a simple disciplinary force in the open classroom is sufficient to increase on-task performance, it does not indicate that the students are "learning" at an increased rate. This seems to counter the traditional classroom emphasis on teacher control and student obedience as necessary precursors to learning, and to lend support to those proponents of open education that emphasize the child's ability to control effectively his or her own learning rate in a less

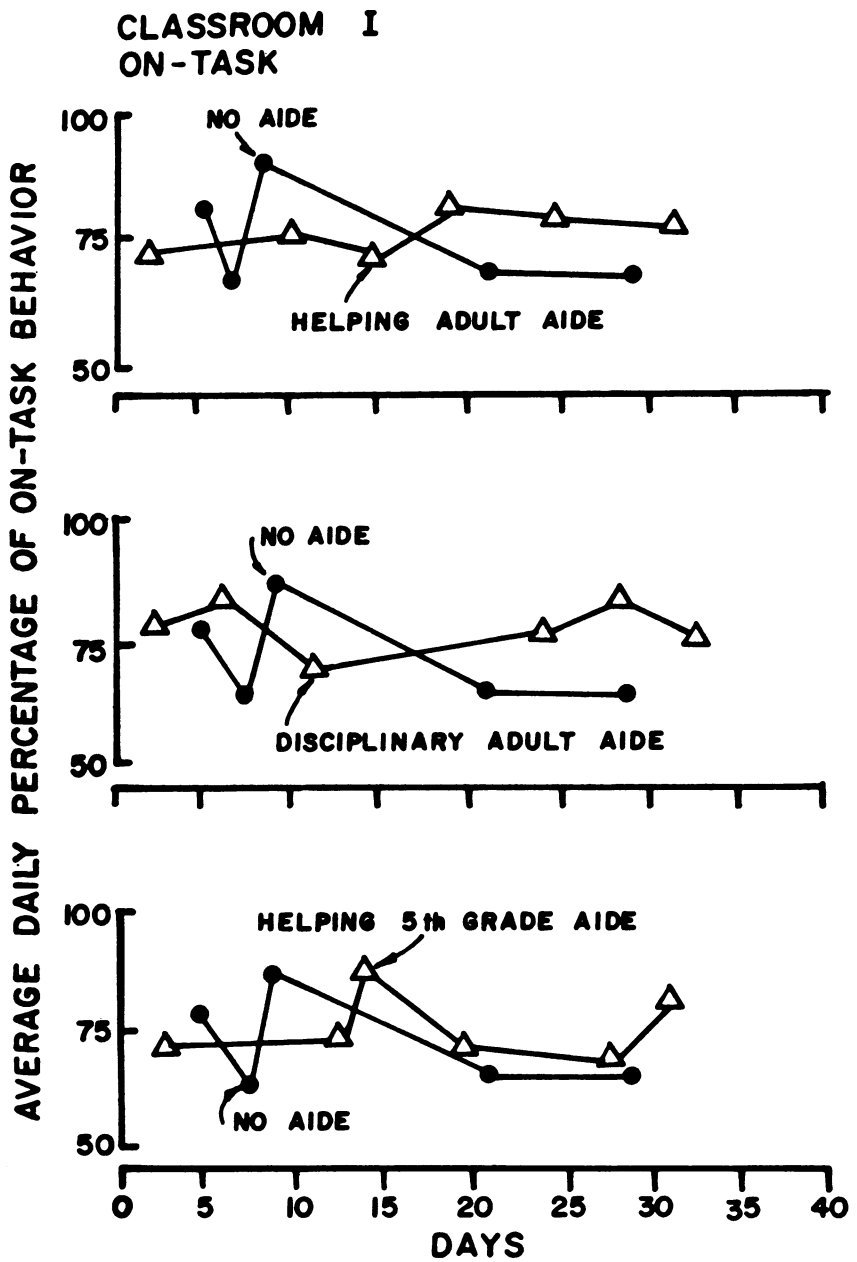

Fig. 3. Mean on-task behavior for Classroom I as a function of each aide condition and compared to a no-aide condition.

restrictive environment (Lovitt and Curtiss, 1969; Winett, 1973; Winett and Winkler, 1972).

Additionally, during the no-aide condition, when a teacher was present only sporadically, the average on-task levels in the two rooms (Class I = 72%, Class II = 73%) were within the range (70% to 80%) usually reported as acceptable in other classroom management studies (Ayllon, Layman, and Burk, 1972; Hall, Lund, and Jackson, 1968; Madsen, Becker, and Thomas, 1968). However, as the data demon-

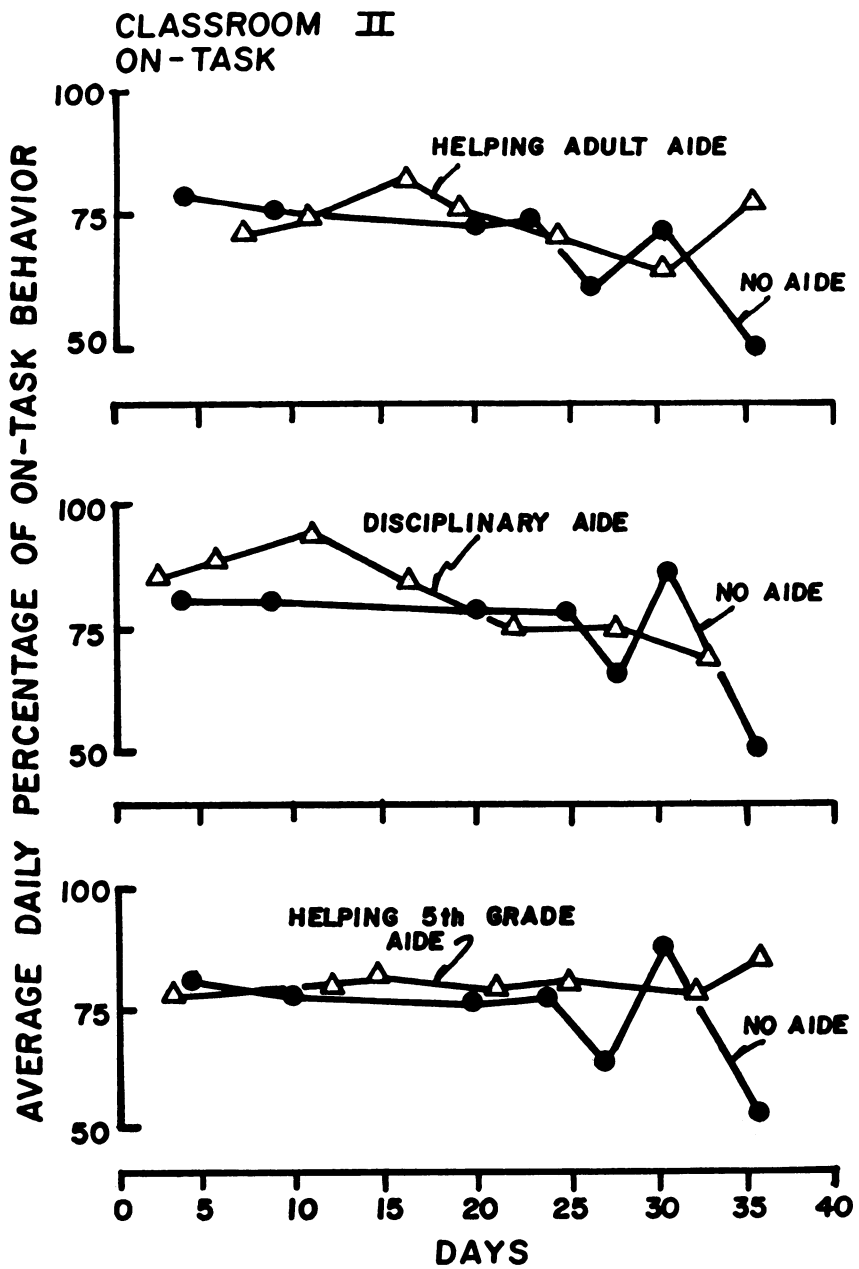

Fig. 4. Mean on-task behavior for Classroom II as a function of each aide condition and compared to a no-aide condition.

strated, this condition still produced the lowest rate of academic progress. Thus, while overall classroom control may not be an issue for the open classroom, learning rate is. The presence or guidance of a teacher or aide is therefore seen as desirable, and given the limitations on time for materials preparation and individualized instruction, aides are seen as important adjuncts to the successful maintenance of the open classroom.

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